



FINAL CLOSEOUT REPORT

SHENANDOAH STABLES SITE **Lincoln County, Missouri**

United States Environmental Protection Agency

September 30, 1999

Final Close Out Report

Shenandoah Stables

Lincoln County, Missouri

I. INTRODUCTION

This Close Out Report documents that the U.S. Environmental Protection Agency (EPA) has completed all response actions at the Shenandoah Stables site in accordance with *Close Out Procedures for National Priorities List Sites* (Office of Solid Waste and Emergency Response [OSWER] Directive 9320.2-09). Remediation of this site involved removal of soils and other material contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin) at concentrations exceeding health-based levels and treatment of these contaminated materials by incineration. Sampling performed following removal of these materials demonstrated that health-based criteria were achieved by the response actions performed at the site. Restoration of the site including backfilling and revegetation has been completed. No further response actions are required at the Shenandoah Stables site.

II. SUMMARY OF SITE CONDITIONS

Site Background

The Shenandoah Stables facility is located in a rural area along Highway US-61 near Moscow Mills, Lincoln County, Missouri, approximately 35 miles northwest of St. Louis, Missouri. The property lies on the upper flood plain terrace of Crooked Creek in a primarily agricultural area. There are a number of single family residences, a livestock operation, and other small businesses on approximately five- to ten-acre parcels around the facility. The predominant land use is pasture land which is primarily vegetated with fescue.

During the early 1970s, activities at Shenandoah Stables included the boarding, training, and sale of horses, and the staging of horse shows. Children periodically played in the arena building. Historical records indicate that the indoor arena was sprayed with 1,500 gallons of dioxin-contaminated waste oil to control dust on May 26, 1971.

Following the spraying of contaminated waste oil, a number of adverse effects were observed in horses, other animals, and in humans. In August of 1971, the facility owner reportedly removed six to eight inches of the contaminated arena soil from the indoor arena. This material was used as fill for a portion of U.S. Highway 61 adjacent to the Shenandoah Stables property, which was under construction at the time. Potentially contaminated materials placed in the road embankment of U.S. Highway 61 comprise a separate site not included in the National Priorities List (NPL) site boundary¹. Horses continued to die after this initial excavation. In March 1972, an additional 18 inches of materials were reportedly removed by the site owner from the arena area and buried in a slough area about 75 feet southeast of the arena structure.

Investigation into the disposal practices of a southwestern Missouri chemical manufacturing facility led EPA to the Bliss Waste Oil Company and subsequently to a number of sites that had potentially been sprayed with dioxin-contaminated waste oil for dust control, including the Shenandoah Stables site. Initial sampling of the site in May 1982 showed 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin) levels as high as 1,750 parts per billion (ppb). In 1984, an article was published by a toxicologist with the Centers for Disease Control, Center for Environmental Health (CDC), recommending one ppb as a level of concern for dioxin in residential soils. In January 1987, EPA proposed clean-up levels to the CDC for the excavation of the eastern Missouri dioxin sites, including Shenandoah Stables. The CDC concurred with the Agency's proposed clean-up levels.

The Shenandoah Stables site was proposed for the NPL on December 30, 1982, and finalized on the NPL September 8, 1983.

Remedial Activities

A Record of Decision (ROD) for interim action at the Shenandoah Stables site was issued by EPA on July 28, 1988. This remedy was implemented using the Emergency Response Clean-up Services (ERCS)

¹The Shenandoah Stables site, site/spill number 0740, CERCLIS ID number MOD980685838 identifies the site appearing on the National Priorities List. The Shenandoah Stables Highway 61 Fill Area, site/spill number 0741, CERCLIS ID number MOD980685846 is not included in the NPL listing.

contract, and required issuance of an action memorandum to mobilize the contractor in accordance with contract requirements. The interim remedy involved excavation and on-site storage of dioxin-contaminated soils pending final management. In areas outside the arena, excavation continued until a residual concentration of one ppb was reached in the upper 12 inches of soil, or until a residual level of less than ten ppb was reached at a depth greater than 12 inches. In the arena and slough area, excavation continued until a residual concentration of less than one ppb was reached in the upper two feet of soil, or until a concentration of less than ten ppb was reached at depths greater than two feet. During this remedial action, decontamination of the arena building was performed to meet criteria of less than 0.4 pg/cm², recommended by the Missouri Department of Health and the Agency for Toxic Substances and Disease Registry (ATSDR). Ambient air monitoring was performed during all phases of earth-disturbing activities to assure that implementation of the remedial action did not result in a further release of contaminated materials. Implementation of this remedial action was completed in May 1989. A total of 6,418 tons of dioxin-contaminated materials resulting from soil excavation and arena building decontamination was containerized in bulk solids storage sacks and placed inside wood-framed, steel-sided storage structures constructed on site pending final management.

The public was first invited to comment on the concept of a comprehensive solution for all of the eastern Missouri dioxin sites at a September 5, 1986, public meeting for the Minker/Stout/Romaine Creek Feasibility Study. At that meeting, it was announced that the state of Missouri had recommended evaluation of Times Beach as a location for siting a temporary thermal treatment unit and that EPA was evaluating this possibility. A Feasibility Study to evaluate Times Beach as a potential location for centralized thermal treatment of designated eastern Missouri dioxin sites was to be completed and released for public comment.

The Times Beach Feasibility Study was released for public comment from December 29, 1986, through March 27, 1987. A public meeting was held on February 12, 1987, to discuss alternatives evaluated in the study and to present the Agency's proposed remedy.

The Proposed Plan for Times Beach and the Minker/Stout/Romaine Creek sites was released February 19, 1988. A public comment period was held from February 19 through March 18, 1988, and a

public meeting was held in Eureka, Missouri, March 10, 1988. On September 29, 1988, a ROD was signed by the Assistant Administrator, OSWER, that provided for a temporary incinerator to be located at Times Beach for the treatment of dioxin-contaminated materials from the Times Beach and the Minker/Stout/Romaine Creek sites. The ROD further provided that the temporary incinerator would be available to treat dioxin-contaminated materials from the other eastern Missouri sites, if subsequent remedy selections were made for those sites that included thermal treatment.

On August 24, 1990, the EPA released the Proposed Plan for Final Management of Dioxin-Contaminated Soil, Shenandoah Stables, Moscow Mills, Missouri. This Proposed Plan presented the EPA's preferred remedy involving transportation of dioxin-contaminated materials currently in storage at the Shenandoah Stables site to Times Beach for thermal treatment using the temporary thermal treatment unit, consistent with the September 29, 1988, Times Beach ROD. A public meeting to discuss the Shenandoah Stables Proposed Plan was conducted on September 19, 1990, at the Moscow Mills Community Center. Public comments were accepted by the Agency through September 24, 1990. A Responsiveness Summary was prepared which addressed comments received during the public comment period for the Shenandoah Stables Proposed Plan. A ROD was signed for the Shenandoah Stables site on September 28, 1990, that selected off-site thermal treatment of dioxin-contaminated materials at Times Beach as a component of the remedy.

On December 31, 1990, a Consent Decree was entered in the Eastern District of Missouri between EPA, the state, and the primary potentially responsible party group. The Consent Decree provided for a *mixed work* settlement that required each party to undertake certain tasks. Generally, EPA was responsible for excavation and transportation of dioxin-contaminated soils from 26 eastern Missouri dioxin sites, including Shenandoah Stables, to Times Beach for incineration. The settling defendants were responsible for construction of a temporary incinerator at Times Beach and incineration of dioxin-contaminated materials from the 27 sites (including Shenandoah Stables).

Implementation of activities at Times Beach, including mobilization and operation of the temporary incinerator, was performed by the settling defendants in accordance with the December 1990 Consent Decree. The settling defendants awarded a

contract for the temporary incinerator in February 1992. Initial testing of the incinerator was performed in December 1995. Full-scale operation of the incinerator commenced on March 17, 1996, and was completed June 16, 1997. A total of 265,354 tons of dioxin-contaminated materials from the 27 eastern Missouri dioxin sites was treated and disposed at Times Beach, including the 6,452 tons of materials from Shenandoah Stables that is the total from the site including additional materials excavated contemporaneous with transportation activities. A Certification of Completion for the Shenandoah Stables site was issued to the settling defendants by EPA on August 15, 1997, in accordance with provisions of the 1990 Consent Decree.

An ambient air monitoring network was operated throughout the incineration of dioxin-contaminated soils at Times Beach. The network included four on-site and two off-site monitoring stations incorporating 17 monitors measuring ambient dioxin and PM-10 levels. The air monitoring demonstrated that there was no discernible increase in airborne dioxin or PM-10 levels at Times Beach resulting from implementation of the remedial action.

Dioxin-contaminated materials from the Shenandoah Stables site were transported to Times Beach by an EPA contractor and delivered to the settling defendant's contractor inside a feedstock handling building operated under negative pressure to control fugitive emissions. The EPA emergency response contract was again utilized to implement EPA's responsibilities at the Shenandoah Stables site under the Consent Decree. Transportation of contaminated materials from the Shenandoah Stables site to the Times Beach site commenced on August 26, 1996, and was completed October 1, 1996. Additional soil sampling was performed at the Shenandoah Stables site concurrent with the final remedial action, upon recommendation from ATSDR, to determine if the initial excavation had achieved the clean-up criteria for a specific area. As a result of this sampling, an additional 34 tons of contaminated soil were excavated and transported to Times Beach for treatment during the final remedial action. A total of 6,452 tons of dioxin-contaminated materials from the Shenandoah Stables site was transported to Times Beach for incineration. Ambient air monitoring was conducted during excavation and transportation activities.

Following removal of contaminated materials from interim storage, the three storage buildings were decontaminated by pressure washing and sampled. The storage structures were left on site

and abandoned as excess government property. Site restoration at Shenandoah Stables was completed following decontamination of the storage structures in October 1996.

III. DEMONSTRATION OF CLEAN-UP ACTIVITY QUALITY ASSURANCE AND QUALITY CONTROL

Removal of contaminated soils at the Shenandoah Stables site was accomplished using a sampling protocol designed to provide a 95 percent upper confidence level for analytical results used to guide the excavation. The sampling procedures applied were consistent with a protocol described in "A Sampling Strategy for Cleanup of Dioxin in Soil" by J.H. Exner, IT Corporation, and R.O. Gilbert and R.R. Kinnison, Batelle-Northwest Laboratories, submitted to Environmental Emergency Services Company, Chesterfield, Missouri, in July 1984. This methodology involves collecting a minimum of three fifty- μ l aliquot samples from an area not to exceed 5,000 square feet within the site boundaries. A statistically-based calculation is then performed that produces a value that should not be exceeded, with 95 percent confidence, by the average concentration across the area. This sampling approach was adopted as EPA Region 7 Standard Operating Procedure 2230.1A, "Procedure for Collecting Soil Samples and Using the Resultant Data to Calculate Exposure Unit Statistics".

Analyses of samples collected to guide the excavation was performed in accordance with the "Contract Laboratory Procedure for Rapid Turnaround Dioxin Analysis". This analytical procedure was specifically developed by EPA Region 7 to support response activities being performed at the eastern Missouri dioxin sites. This analytical methodology provides a detection level of 0.3 ppb for 2,3,7,8-tetrachlorodibenzo-p-dioxin² in soil samples. Analytical results are generally available within 24 hours, depending on the location of the laboratory performing the analysis and shipping considerations.

The sampling and analysis program was supported by a rigorous quality assurance/quality control (QA/QC) program that included the

² Prior sampling of both site soils and source materials demonstrated that other 2,3,7,8-substituted dioxin and furan congeners were not present at levels that contributed significantly to the dioxin toxicity equivalence. Subsequent analyses were limited to 2,3,7,8-TCDD.

use of performance evaluation samples, field duplicate samples, and laboratory blanks. The QA/QC procedures employed are documented in EPA Region 7 Standard Operating Procedure 1410.3A, "Quality Assurance Project Plan for Emergency Planning and Response". Site-specific documentation consistent with this Standard Operating Procedure was developed and approved prior to removal of dioxin-contaminated materials at the site.

Excavation of dioxin-contaminated materials from the site was performed under the direct field supervision of an EPA On-Scene Coordinator, with assistance from the Missouri Department of Natural Resources. This level of oversight assured that all designated sampling, analytical, and QA/QC procedures were followed on a daily basis. Daily progress and oversight are documented in a series of pollution reports generated through the course of the response actions taken at the site.

Following initial removal of dioxin-contaminated arena soils from the arena building and after removal of dioxin-contaminated materials from interim storage at the site, buildings were decontaminated and sampled. Wipe samples were collected in accordance with U.S. EPA Region 7 Standard Operating Procedure 2230.2A, "Wipe Sampling for Surface Contamination". Wipe samples were analyzed in accordance with "Contract Laboratory Procedure for Rapid Turnaround Dioxin Analysis". This sampling and analytical procedure provides for a lower detection level equivalent to the health-based standard of 0.4 pg/cm².

The QA/QC program used throughout the interim and final actions was rigorous and in conformance with EPA and state standards. The EPA and the state have determined that all analytical results are accurate to the degree necessary to assure the effectiveness of the clean up and consistency with the interim and final RODs and QA/QC plans.

IV. MONITORING RESULTS

Soil sampling was performed in accordance with the statistically-based protocols described above throughout the removal of dioxin-contaminated soils at the Shenandoah Stables site to 1) identify boundaries of contamination, 2) guide excavation of contaminated areas, and 3) verify that clean-up criteria were achieved following removal of contaminated materials. Boundary sampling performed prior to excavation, and as excavation proceeded,

defined the areal extent of contamination exceeding health-based levels. Verification sampling demonstrated that health-based criteria were achieved at the exposed surface of the excavation following removal of contaminated materials. This sampling program ensured that soils and other materials exceeding health-based levels were removed from the site. Excavated areas were backfilled to original grade with clean materials.

All sampling results generated during the removal of contaminated materials from the site are included in the Administrative Record for the site, which will be maintained for a period of ten years from issuance of the certification of completion to the settling defendants, pursuant to the December 31, 1990, Times Beach Consent Decree.

V. SUMMARY OF OPERATION AND MAINTENANCE

The remedial response at the site was successful in removing dioxin-contaminated materials exceeding health-based levels for unrestricted use within the boundaries of the NPL site. No operation and maintenance (O&M) activities are necessary to maintain the continued effectiveness of the remedy.

VI. PROTECTIVENESS

The 1988 ROD for this site established criteria for the removal of soils and other materials contaminated with dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) from this site. This criteria involved removal of soils exceeding one ppb dioxin in the upper one foot of the arena and slough areas, and removal of soils exceeding five to ten ppb at depths greater than two feet in the arena and slough areas. For other areas, removal of soils exceeding one ppb in the upper one foot or exceeding five to ten ppb at depths greater than one foot was required. The criteria also provided for a maximum depth of excavation of four feet, or upon encountering bedrock, although these criteria were never applied since residual dioxin concentrations meeting the previous criteria were achieved prior to reaching this depth or bedrock.

The completed response activities at the site have succeeded in achieving the health-based criteria determined to be necessary to provide protection for human health and the environment. No O&M is necessary to assure the continued effectiveness of the completed remedy. No further Superfund response is necessary to protect human health and the environment at this site.

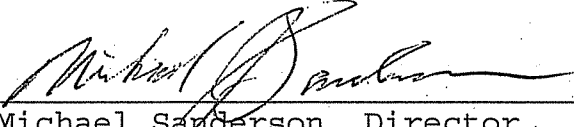
VII. FIVE-YEAR REVIEW

Hazardous substances will not remain at the site above health-based levels after the completion of the remedial action. Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 121(c) and as provided in OSWER Directive 9355.7-02, *Structure and Components of Five-Year Reviews*, May 23, 1991, and OSWER Directive 9355.702A, *Supplemental Five-Year Review Guidance*, July 26, 1994, EPA is not required to conduct a statutory five-year review for this site. No five-year reviews will be conducted.

VIII. BIBLIOGRAPHY

1. Record of Decision for Non-Final Management of Dioxin-Contaminated Soil and Structures at Shenandoah Stables, Moscow Mills, Missouri, United States Environmental Protection Agency, July 28, 1988.
2. Record of Decision for Final Management of Dioxin-Contaminated Soil, Shenandoah Stables, Lincoln County, Missouri, United States Environmental Protection Agency, September 28, 1990.
3. Remedial Action Report, Shenandoah Stables Operable Unit Number 1, United States Environmental Protection Agency, October 18, 1989.
4. Remedial Action Report, Shenandoah Stables Operable Unit Number 2, United States Environmental Protection Agency, September 30, 1998.
5. Preliminary Closeout Report, Shenandoah Stables, United States Environmental Protection Agency, September 30, 1997.

Approved:


Michael Sanderson, Director
Superfund Division

9/30/99
Date

EPA REGION 7 SUPERFUND SITE FILING FORM

Site Name: Shenandoah Stables EPA ID#: MD5980685-838 SSID # 0740Person Submitting the Record: P. Sanchez Telephone #: 7679 Date Submitted: 9/8/09
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Place below a ☒ in the appropriate box, only one ☒ for each form and fill in the field below.☐ 1.0 Pre-Remedial/Pre-Removal

- ☐ 1.1 Sampling and Analysis Data, Chain of Custody and Data Transmittals
☐ 1.2 Hazard Ranking System (HRS) Information
☐ 1.3 Federal Facilities Background (Current & Former)

☐ 2.0 Removal Response

- ☐ 2.1 Sampling and Analysis Data, Chain of Custody and Data Transmittals
☐ 2.2 Pollution Reports
☐ 2.3 ICS Documents (includes Incident Action Plan & ICS Form 214)

☐ 3.0 Remedial Investigation/Combined RI/FS

- ☐ 3.1 Sampling and Analysis Data, Chain of Custody and Data Transmittals

☐ 4.0 Feasibility Study

- ☐ 4.1 Sampling and Analysis Data, Chain of Custody and Data Transmittals

☐ 5.0 Record of Decision (ROD)/Proposed Plan☐ 6.0 Remedial Design

- ☐ 6.1 Sampling and Analysis Data, Chain of Custody and Data Transmittals

☐ 7.0 Remedial Action

- ☐ 7.1 Sampling and Analysis Data, Chain of Custody and Data Transmittals

☒ 8.0 Site Close-Out/NPL Deletions/5-Year Reviews☐ 9.0 Operation and Maintenance

- ☐ 9.1 Sampling and Analysis Data, Chain of Custody and Data Transmittals

☐ 10.0 Enforcement/Orders

- ☐ 10.1 EPA Administrative Orders, Consent Decrees, DOJ Referrals and CERCLA 120 Federal Facilities Agreements
☐ 10.2 Trial Documents
☐ 10.3 Property Access Documents
☐ 10.4 Internal AR Acknowledgement Form and Repository Acknowledgement Form

☐ 11.0 Potentially Responsible Party (PRP) Searches

- ☐ 11.1 PRP Lists
☐ 11.2 Individual PRP Files
☐ 11.3 PRP Steering Committee or PRP Group

☐ 12.0 Cost Recovery☐ 13.0 Community Relations

- ☐ 13.1 Mailing Lists

☐ 14.0 Congressional Relations☐ 15.0 Index of Documents furnished under FOIA by Superfund

[Note: Filed chronologically by FOIA number]

☐ 16.0 Natural Resources Trustee

17.0 Site Management Records

[Note: Closed Section - DO NOT USE]

18.0 Initial Remedial Measure (IRM) Records

[Note: Closed Section - DO NOT USE]

19.0 Resource Conservation and Recovery Act

[Note: RCRA Records, Closed Section - DO NOT USE]

☐ 20.0 Interagency Agreement (IAG)

[Note: All documents are filed by IAG number and Chronologically]

☐ 21.0 Cooperative Agreements (CA)

[Note: All documents are filed by CA number and Chronologically]

☐ 22.0 EPA Contractor's Related Documents

[Note: All documents are filed by the contract number, then the work assignment number, and chronologically]

☐ 23.0 State Superfund Contracts

[Note: All documents are filed by the contract number, then the work assignment number, and chronologically]